SCIENCE NEEDS/OPPORTUNITIES STATEMENT

NEUTRON DETECTION FOR SORTING REMOTE-HANDLED RADIOACTIVE WASTE INTO TRU vs. NON-TRU

Identification No.: RL-DD035-S
Date: November 2001

Program: 300 Area Facility Transition
OPS Office/Site: Richland Operations Office/Hanford Site
PBS No.: RL-RC06
Waste Stream: Radioactively contaminated materials and equipment, tanks, pipes, gloveboxes, ducting, etc.
TSD Title: N/A
Operable Unit (if applicable): N/A
Waste Management Unit (if applicable): N/A
Facility: Building 324

Priority Rating:

This entry addresses the "Accelerated Cleanup: Paths to Closure (ACPC)" Priority:

____ 1. Critical to the success of the ACPC
____ 2. Provides substantial benefit to ACPC projects (e.g., moderate to high lifecycle cost savings or risk reduction, increased likelihood of compliance, increased assurance to avoid schedule delays)
_X_ 3. Provides opportunities for significant, but lower cost savings or risk reduction, and may reduce uncertainty in ACPC project success.

Need Title: Neutron Detection for Sorting Remote-Handled Radioactive Waste into TRU vs. Non-TRU

Need/Opportunity Category: *Science Opportunity* - The site desires an alternative or enhancement to the current or planned baseline technology/process (e.g., a baseline approach exists but can be improved). Fundamental science information is required to improved the process or reduce uncertainty.

Need Description: new class of field-applicable neutron detectors is needed to measure transuranics (TRU) in remote-handled waste with high gamma radiation. The science need is solving the problem of neutron-gamma discrimination in detector materials (scintillators, gases, or other types) so that a new class of neutron detectors may be developed for sorting transuranic-containing remote-handled LLW. The new detectors must be highly sensitive to the relatively few neutrons that are emitted from transuranic waste but insensitive to the much more numerous gamma rays that produce the high radiation associated with remote-handled waste. (Traditional gamma-ray spectrometry is

not expected to be practical for TRU measurements because of interferences from the intense gamma radiation produced by other sources, such as Cs-137.)

Schedule Requirements:

Earliest Date Required: (01/01/01)
Latest Date Required: (09/30/06)

Problem Description: There is an urgent need to sort remote-handled low-level waste containing transuranic materials. Waste with high levels of cesium-137 and moderate levels of transuranic materials is collected and packaged in steel containers (grouted and ungrouted) as part of the 324 Building B-Cell Cleanout Project. The transuranic content has been established in the past by an indirect method based solely on dose rate measurements and limited sampling and analysis; such an approach is now in question. Many other buildings and waste sites within the DOE complex also have similar needs for distinguishing TRU in the presence of high gamma-ray radiation. As an example, caissons (underground tanks at Hanford into which highly contaminated items were inserted through a deviated chute) also contain TRU waste that has high gamma radiation. Items contaminated to a lesser degree are located in burial grounds that will be excavated and their waste sorted by TRU content.

Potential Life-Cycle Cost Savings of Need (in $000s) and Cost Savings Explanation: TBD

Benefit to the Project Baseline of Filling Need: Benefits realized by the projects should include characterization task efficiencies/schedule reduction, waste volume/class reduction and the reduction in associated disposal costs. Dose reduction and ALARA-based improvements should also be realized.

Relevant PBS Milestone:

TRP-06-921	324 Deactivation Complete	September 22, 2006

Functional Performance Requirements: A method is needed that will allow for real-time differentiation between TRU and non-TRU waste, between low-level waste and free-release waste and/or provide quantitative assessment of remaining contamination. Characterization is required for a variety of configurations including walls, ceilings, equipment, hot cells, and hot cell support equipment.

a) Ducts/Piping - Improvements are needed for the remote, in situ characterization of contamination levels in ducts and piping. Ductwork may have obstructions and limited access. Contaminants include cesium, strontium, uranium, and transuranics. The technology would need to be adaptable to a variety of configurations. Ducts and piping constitute examples of long-length and large-size contaminated equipment at Hanford that needs to be measured for TRU content in high gamma-ray fields. Other examples include long items to be removed from underground liquid-waste storage

tanks and large pieces of contaminated process equipment. Long-length and large-size items share the common problem that they will not fit into barrels or boxes where conventional TRU analysis techniques can be applied. Many of these items are contaminated only in localized spots. By screening large items for localized TRU, it should be possible to segregate the contaminated parts and greatly reduce the volume of waste that needs to be treated as TRU.

b) **Remote Radiation Mapping** - Remotely deployable radiation mapping techniques are required. Methods should permit the identification of hot spots within an area containing high radiation levels.

c) **Segregation Techniques** - Techniques are needed that can differentiate between contaminated and non-contaminated material and for equipment that has inaccessible surfaces. Current technology allows crushed material on the order of 1 inch or less to be segregated through the assay of the material on a conveyor belt. The improved technology should permit the real-time characterization of materials larger than crushed materials.

d) **Verification** - Facility Endpoint Criteria limit the amount of contamination that can remain in the facility for long-term surveillance. Techniques are needed to provide accurate, verifiable measurement of the remaining contamination on large surfaces and equipment.

Work Breakdown Structure (WBS) No.: 1.04.10, 324/327 Buildings Stabilization/Deactivation

TIP No.: TRP-03-901, Select Technologies for Characterization and Removal of Contaminated Piping, June 27, 2003

End-User: EM-40

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